

Gilt Edge Mine Superfund Site NRRB; Response to Comments

Context for NRRB Review

EPA created the National Remedy Review Board (NRRB) in January 1996 as part of a comprehensive package of reforms designed to make the Superfund program faster, fairer, and more efficient. The NRRB is a peer review group that understands both the EPA regional and headquarters perspectives in the remedy selection process. It reviews proposed Superfund cleanup decisions that meet cost-based review criteria to assure they are consistent with Superfund law, regulations, and guidance. The NRRB is composed of managers or senior technical or policy experts from EPA offices important to Superfund remedy selection issues.

Because the cost of the remedies being considered for the Operable Unit (OU1) of the Gilt Edge Site exceeded \$25 million, the remedy review board conducted a review of this project in December, 2007.

Overview of the Selected Action

The Gilt Edge Mine is located in the Northern Black Hills, near the towns of Deadwood and Lead, South Dakota. It is a former 258-acre open pit, cyanide heap-leach gold mine. The mine operator abandoned the site in 1999. The site was placed on the NPL in December, 2000. EPA has conducted numerous actions at the site including the implementation of three records of decisions to treat acid rock drainage (ARD) (OU3) and to remediate the Ruby Waste Rock Dump (OU3). Releases of acid mine drainage and exposed mining wastes pose a threat to human health and the environment. OU1 addresses mine wastes located within boundaries of the mine. The proposed remedy for OU1 focuses on reducing ARD generation and minimizing risk of exposure through removal, consolidation, and covering the contaminated materials.

Response to the NRRB Advisory Recommendations

The NRRB reviewed the information package describing the Regions proposed cleanup alternatives with Victor Ketellapper and Russ Leclerc from Region 8. Representatives from the State of South Dakota, Mark Larwensen, Mike Cepak, and Eric Holm participated by phone. On January 28, 2008, the board provided EPA Region 8 with their final comments on the proposed remedy. The NRRB comments are stated below. Each comment is followed by the response from Region 8.

1. The package presented to the Board listed multiple preliminary remediation goals (PRGs), as well as multiple remedial action levels (RALs) for different human receptors (i.e. ATV riders, hikers, and future residents) and cancer risk targets. However, it was not clear what the selected cleanup levels in the preferred alternative would be for the site. The Board recommends that the Region clarify in the decision document what cleanup levels will be selected for specific areas.



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Response: PRGs and RALs were selected based on protecting environmental receptors, onsite workers, and low intensive recreational users, such as hikers). The PRGs selected for arsenic and thallium in surface soil were 596 mg/kg and 134 mg/kg, respectively. The RALs for arsenic and thallium in surface soil are 1125 mg/kg and 200 mg/kg, respectively. The selected cleanup levels for the preferred alternative are the RALs, which will be applied throughout the site.

2. The package presented to the Board was not explicit with respect to human health and ecological risks and the effectiveness of the remedy in reducing these risks. The decision documents should explain how the proposed remedy reduces these risks. For example, at the meeting the Region described how the preferred remedy would reduce the threat of a catastrophic release of water contaminated with acid rock drainage (ARD). Such a release would adversely affect the surface water aquatic community, as well as pose a threat to ground water where the surface water reaches the “loss zone,” and recharges aquifers used for residential and municipal water supplies. The example of risk reduction and others should be described in the decision document.

Response: The feasibility study and proposed plan were revised to include a discussion on the effectiveness of each alternative in addressing human health and ecological risks including those risks associated catastrophic releases of water contaminated with ARD. In addition, an analysis of the effectiveness of each alternative in preventing releases of ARD-contaminated water was included in Appendix G of the feasibility study.

3. The preliminary remedial action objectives (RAOs) presented in the package do not appear to include a specific objective for restricting site uses to allow only low intensity recreational visitors or hikers and prevent residential uses or ATV rider use of the site. The package presented to the Board did present a RAO that stated that there would be controls such that “any disturbance follows best management practices and prescribed methods.” The Board recommends that the Region develop a more specific RAO that addresses the need for detailed institutional controls (ICs) to protect current and future human and ecological exposures.

Response: The following RAOs have been added to the feasibility study:

“Implement institutional controls to prevent the unacceptable uses of groundwater that pose human or ecological risks.”

“Implement institutional controls that limit residential and off-road motorized vehicle rider use and allow only low intensity recreational site users and commercial workers.”

4. The package presented to the Board appears to presume that soil cleanup levels do not need to be established for much of the sites because areas that pose human health or ecological risk will be covered to reduce generation of ARD. The Board recommends that the Region consider whether areas associated with human health risk will be covered under the alternatives, or whether some areas need to be covered to prevent direct contact exposure. Specifically, given

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that water treatment will continue, the Region should consider whether there are areas that could be covered with a simple soil cover to act as an exposure barrier and address direct contact risk rather than a cap to reduce or eliminate infiltration to prevent ARD generation, which could reduce costs without impacting protectiveness.

Response: The use of exposure barriers versus cover systems was reevaluated for all areas. The preferred alternative in the final FS was adjusted to allow for mine waste to be covered in place including the west portion of the Process Plant remediation subarea. In these areas, 6 inches of topsoil and 12 inches of subsoil will be placed over the mine waste to provide an exposure barrier. This change resulted in smaller volumes of imported fill and lower costs for each alternative without impacting protectiveness.

5. The package did not adequately describe the relative risk benefits associated with the various alternatives. For example, the present worth cost of Alternative 5 is nearly \$50M higher than Alternative 3, yet both appear to represent effective solutions and provide protective remedies. The Board recommends that the Region further evaluate the risk reductions associated with the alternatives and clearly explain the results of this analysis in the decision documents. The Board encourages the Region to consider this information and other factors, including cost, in identifying a preferred, cost effective, remedial alternative.

Response: All alternatives were reevaluated with respect to the relative risk benefits and costs in the feasibility study. Also, capital cost reductions associated with NRRB Comments 4 and 8 have resulted in significantly lower costs for all alternatives and the preferred alternative. The capital and present value costs presented for each of the alternatives in the final FS are presented in the following table:

<i>Alternative</i>	<i>Capital Cost Draft FS</i>	<i>Capital Cost Final FS</i>	<i>Present Value Cost Final FS</i>
<i>1</i>	<i>0</i>	<i>0</i>	<i>\$220,000</i>
<i>2</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>
<i>3</i>	<i>\$34,420,000</i>	<i>\$26,700,000</i>	<i>\$24,831,000</i>
<i>4</i>	<i>\$82,785,000</i>	<i>\$51,965,000</i>	<i>\$46,268,000</i>
<i>5</i>	<i>\$94,104,000</i>	<i>\$58,541,000</i>	<i>\$50,340,000</i>

Note:

Water treatment operation and maintenance costs were not included in the final Feasibility Study per NRRB comment 6.

It was anticipated that the construction would be conducted over 3 years, resulting in the present value costs being lower than the estimated capital costs.

6. As presented to the Board, Alternatives 3 through 5 focus primarily on reducing the volume of ARD generation and subsequent contaminant loading in surface water coming from the site. These alternatives accomplish this by removing, consolidating, and covering various amounts of

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waste rock, fill, and bedrock sources, along with treatment of ARD. The Region's preferred alternative (5) is the most costly and also the most aggressive in terms of ARD reduction. According to the Region, one of the major benefits of the preferred alternative compared to alternatives 3 and 4, which are less aggressive in reducing ARD, is that it requires that less water to be treated, thereby reducing operation and maintenance (O&M) costs. However, the information package provided to the Board indicates the capital cost of Alternative 5 is about \$60M higher than Alternative 3 – yet, the total O&M cost is only \$11M less. One might expect a greater difference in total O&M costs, because effective waste management (e.g., capping, subaqueous disposal, etc.) can reduce ARD generation and, consequently, contaminant loading in surface water bodies. The package indicated that construction of the Ruby Repository resulted in more than an 80% reduction in sulfate generation. The Board recommends that the Region further evaluate the O&M cost for Alternatives 3, 4, and 5 to determine whether they actually reflect expected conditions.

As part of this evaluation, the Board recommends that the Region more clearly identify both the ARD volume and metals loading reductions from each element of each alternative. These reductions should then be clearly tied to meeting RAOs. Calculation of a cost per unit of ARD volume or metals loading reduction would be useful in evaluating the relative benefits and cost-effectiveness of each alternative.

The Board recommends that the Region consider utilizing a phased approach to the remedy, with the management of the most highly ARD generating materials being dealt with first. For example, addressing the “Lower Zone of Heap Leach Pad Spent Ore” could be a first priority; it is a relatively small volume of material but is identified as the strongest generator of ARD (see Table 4-1 of package presented to the Board). It may be possible to meet RAOs for the site without consolidating/capping all of the materials envisioned for such action in the preferred alternative.

The Board recommends that the Region consider expected changes in both ARD volume and contaminant loads when selecting an alternative that best balances costs for near-term waste management versus costs for long-term water treatment and the total cost of the remedy. The Board does not believe that the cost estimates provided by the Region support selection of the higher cost alternative. Further, the Board recommends that the Region review the scope of the interim ground water treatment ROD (OU2) to determine the extent to which the O&M cost for ARD are already covered by an existing decision document.

Response: The Region recognizes that implementing the remedy will reduce the volume of ARD generated. However, the contaminant concentrations in that reduced volume will be different and may be higher. Thus, at this time, estimating the cost of long-term water treatment operations could vary greatly depending on water quality and treatment technologies needed to meet discharge standards. (Note: the water treatment facilities are currently being operated under a discharge standard waiver for total dissolved solids and selenium). A process and cost analysis of water treatment alternatives was developed and included in the administrative record

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for this action.

Per the Board's recommendation, additional information on the ARD volume reduction expected from each alternative has been included and discussed with respect to meeting RAOs. However, the additional geochemical data collection and intensive geochemical/ hydrological modeling, needed to estimate metals loading reductions and the cost to treat the resulting ARD volume, was not conducted at this time. This analysis will be conducted, if necessary, as part of a subsequent ROD that addresses water treatment.

Implementing the remedy utilizing a phased approach is discussed in the FS conceptual sequencing diagrams. The FS takes into account the potential for ARD generation by the materials and the logistical concerns associated with moving these materials. The Region has reevaluated the need to consolidate/cap all of the ARD generating materials originally proposed and revised the feasibility study to meet RAOs by addressing some fills in place as discussed in response to Comment 4. Sequencing and phasing of fill removal and consolidation will be further evaluated during the RD based on factors such as the ARD generating potential, logistical concerns, and funding constraints.

The Region found that the interim ROD for OU2, water treatment, takes into account all O&M costs with ARD treatment. Furthermore, the focus of this decision document is OUI, the primary mine disturbance area. The Region has determined that any actions regarding the operation of the treatment facility should remain in OU2 decision documents. For this reason, references to the costs of operation and maintaining the treatment system have been removed from the feasibility study. Also, Alternative 2 was not retained for the final analysis in the feasibility study since this alternative addressed water treatment upgrades. Thus, Alternative 2 did not adequately address human health and environmental risks associated with direct exposure to contaminated soils.

The Region revised the detailed analysis of retained alternatives. Specific changes included updating cost estimates and revising the analysis of site risks associated with contaminated soils and a potential ARD release into the watershed.

7. The remedies proposed by the Region include covering/capping of ARD generating rock with the barrow material and vegetative covers. The Region should consider the risks posed to ecological receptors in evaluating remedy effectiveness of this approach. In particular, the capping material, depth of material, and/or the use of liners should be evaluated in terms of the sustainability of the vegetative cover and sustained risk reduction. For example, cap thickness and material can provide good substrate for vegetation so that vegetation will prevent erosion of cap material. The rooting depth requirements of native species, water requirements, and the depth of winter freezing should be considered in this evaluation.

Response: The Region agrees that the cover parameters identified by the NRRB are critical to the sustainability of the cover and protection of receptors. Capped mine waste will be

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maintained as a forest meadow. Thus, the thickness of the substrate was reduced to reflect this type of vegetation, resulting in reduced borrow materials needed and lower costs for each of the alternatives. During the Remedial Design, the cap thickness parameters identified by the NRRB will be evaluated.

8. The package presented to the Board did not provide detailed information on the design of the cover systems proposed for the preferred alternative. The Region should evaluate potential cost savings in the design of the cover systems and take into consideration the amount of soil placement over the geosynthetic liner that could result in cost savings by reducing the amount of soil that would be imported from off site sources while still meeting the RAOs.

Response: The detailed evaluation and design of the cover systems will be completed during the RD. However the Region has reevaluated the proposed cover system in the feasibility study and reduced the thickness of subsoil from 24 inches to 12 inches based on information about cover systems at similar mine sites in South Dakota. This change resulted in smaller volumes of imported fill and lower costs for each alternative while still meeting RAOs.

9. The package presented to the Board indicated that the preferred alternative would use an area for dewatering and disposal of sludge from the ARD treatment. The Region should evaluate sludge handling and disposal practices as they may impact risks to ecological or human receptors that are exposed to the sludge. The Region should discuss in its decision documents how the sludge disposal cell would be constructed to protect against runoff, run-on, and leaching, and what if any, applicable or relevant and appropriate requirements apply to the generated sludge disposal.

Response: The remedy for OU1 does not specifically address future disposal of WTP sludge, as it is associated with OU2. However, the feasibility study did evaluate options for creating sufficient space for future construction of sludge disposal cells as part of OU2 operations. The Region will address sludge handling and disposal practices in future decision documents for OU2.

10. The Board recommends that disposal of sludge in subsurface mine workings or into one of the open pits be evaluated as part of a remedial alternative. This method of sludge disposal could potentially reduce costs and could have potential benefits of placing alkalinity in a location where it could provide further buffering of acidic water.

Response: The Region has completed leaching tests on the sludge and determined that the Gilt Edge Mine Site water treatment plant sludge released high concentrations of metals (cadmium, copper, manganese, and zinc) in the strong acid leach tests. Storage of sludge in the subsurface mine workings or open pits, (which includes large volumes of strongly acidic water) would negatively impact groundwater and constitute an additional long term source of metals contamination to the interconnected groundwater system. Therefore, the Region does not recommend placing sludge in the mine workings or the open pits at this site.

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11. The Board recommends that the Region favor remedial alternatives that do not require pumping of ground water to control hydraulic head as a component, or at least minimize any pumping of ground water to maintain ground water levels in the filled pit. ARD generating material should be placed either above the anticipated high water table or in an anaerobic zone to below the water surface to avoid ARD generation. Pumping can be a significant O&M expense.

Response: Since the bedrock walls and underground mine workings within the pits are an ARD source, ARD generation cannot be avoided. However, the Region has evaluated ways to minimize ARD generation and included them in the feasibility study. Furthermore, the FS includes a discussion on sequencing and placement of strongly ARD-generating material above the water table. Reclamation fills with lower ARD generating potential will be placed below the water table while general fills with higher ARD potential will be placed in the vadose zone above the submerged fills.

Collection and treatment of ARD within disposal locations (filled pits) is needed to maintain water levels within the filled pits to reduce impacts to groundwater. During RD, the Region will evaluate ways to minimize pumping required to maintain these levels.

12. The package presented to the Board and the Region's presentation indicated that ARD moving off site will be captured and stored in the Anchor Hill Pit prior to treatment. The Board recognizes the need to use the pit for storage; however, the hydraulic connection between the Anchor Hill Pit and the ground water system has not been well characterized or quantified (particularly the potential for preferential flow along fracture zones). The Board recommends that the Region further investigate this issue in order to better understand and minimize the risk of subsurface releases of ARD and contaminants from the Anchor Hill Pit.

Response: The Region will continue to monitor the impact of storing water in the Anchor Hill Pit. A water management plan will be developed in order to minimize the impact of stored water on the groundwater system.

13. The Board notes that gold mining operations caused the releases of hazardous substances that make this remedial action necessary. A mineral gold ore deposit remains in a parcel in the northwest area of the site, which is owned by the U.S. Forest Service. Future mining may create future waste generation and releases; and, if not prohibited, at a minimum it should be properly planned, managed, and controlled. The Board recommends that the Region work with the Forest Service to restrict or prohibit future mining activities at this portion of the site (e.g., withdrawal of the site from potential mining claims). The Region should consider coordinating with the Justice Department and the Forest Service to add the Forest Service as a party to the contemplated settlement or consent decree (along with the state and potentially responsible parties) to ensure the long-term integrity of the cleanup.

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Response: The Region will identify the status of land managed by the U.S. Forest Service within and adjacent to the Gilt Edge Mine Site. The Region anticipates settling with the U.S. Forest Service in order to ensuring the long-term integrity of the cleanup and to restrict future mining at the site.